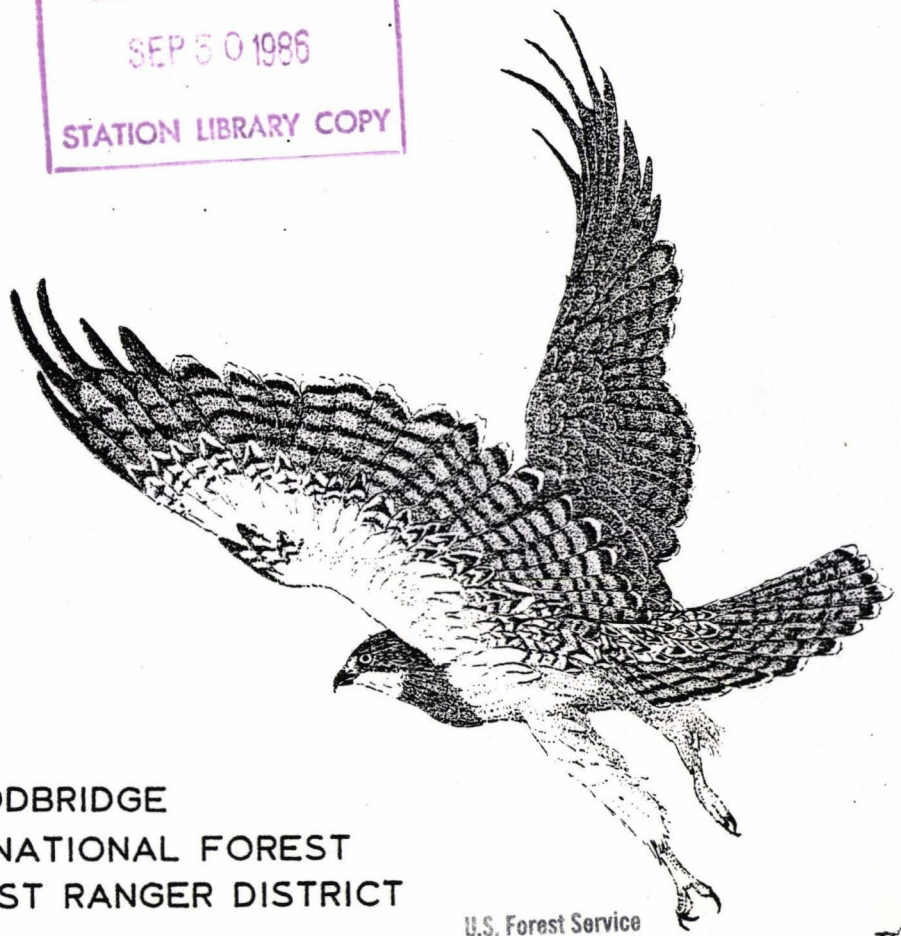
# IOLOGY AND MANAGEMENT OF SWAINSONS HAWKS IN THE BUTTE VALLEY, CALIFORNIA





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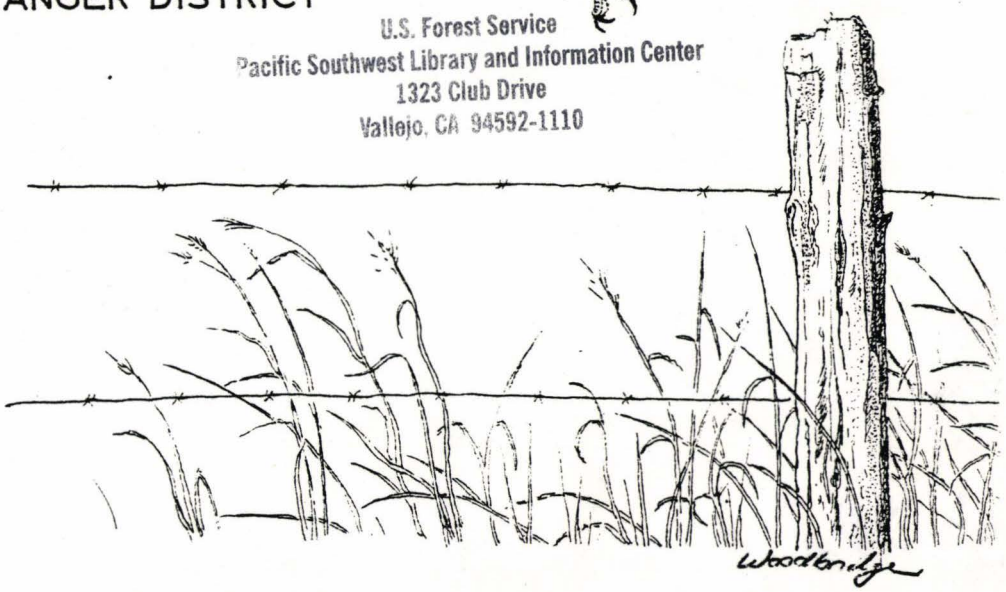


## INTRODUCTION

Recent studies have documented declines in Swainson's hawk (Buteo swainsoni) populations in southern Saskatchewan (Houston and Bechard 1983), Oregon (Littlefield et. al. 1983), Nevada (Herron and Lucas 1978), and California (Bloom 1979). Significant declines in fall migrants have also been noted (Remsen 1978). Considered at the turn of the century to be one of California's most abundant buteos (Sharp 1902, Willett 1912), Swainson's hawk populations in that state may have declined by as much as 90% (Bloom 1979). The causes of this decline have been widely speculated upon and several theories are currently being investigated. Habitat loss (Bloom 1979, Littlefield et. al 1983), environmental contaminants (Bloom 1979), and loss of birds on South American wintering grounds (Bloom 1979, Littlefield et. al. 1983) are probably the most likely causes; yet current data do not strongly support a major role for any single cause.

The Swainson's hawk was listed as a Threatened species by the California Department of Fish and Game in 1983. It is listed as Sensitive or of Special Concern in Oregon, Nevada, Illinois, Iowa, and Missouri, and is currently under consideration for Federal listing.

Data from extensive studies of western Swainson's hawk populations support Federal listing, but more intensive studies of local populations are needed before causes of population declines can be determined and management strategies developed. In this report I describe the biology of Swainson's hawks in the Butte Valley, northeastern California, during the 1984 and 1985 nesting seasons. The objectives of this study were: 1) to estimate the abundance of Swainson's hawks in the Butte Valley, 2) to determine reproductive success and productivity, and 3) to investigate habitat use and relationships of this species with current land practices on public and private lands.

## STUDY AREA

The Butte Valley is located in the extreme northern portion of California, bounded on the north by the California-Oregon border and on the south by the Mt. Shasta-Butte Creek drainage divide (Fig. 1). The eastern boundary is Mahogany Ridge, which separates the Butte Balley from the Tulelake-Lower Klamath Basin. To the west, the Cascade Mountains separate the Butte and Shasta Valleys. The Butte Valley basin occupies about 700 square miles; however, this study deals primarily with the level valley floor, ranging from 4230 to 4400 feet in elevation and occupying approximately 170 square miles.

### Climate

The climate of the Butte Valley is characterized by cold, wet winters and warm, dry summers. Temperatures range from 100°F in the summers to less than 20°F in the winters. The average growing season is 120 days. Average annual precipitation on the valley floor is 12 inches, a significant proportion falling as snow. Prevailing winds are from the north and average less than 31 mph. Stronger winds occur with storms from the south.

## Vegetation And Land Use

Prior to the early 1900's, the native vegetation in the Butte Valley consisted largely of Basin wild rye (Elymus cinereus) with minor components of big sage (Artemesia tridentata), greasewood (Sarcobatus vermiculatus), and rabbitbrush (Chrysothamnus sp.). A local resident described the valley in 1880 as "a continuous plain of ryegrass, as high as a horse's belly." Tree species were limited to a few willows (Salix sp.) along creekbeds on the western boundary of the valley and Ponderosa pines (Pinus ponderosa) grew on the valley floor at the southern end of the valley.

Overgrazing resulted in the virtual elimination of Basin wild rye from the valley in the early part of this century, and favored dense stands of big sage, greasewood, and rabbitbrush. Introduced grasses, such as cheatgrass (Bromus tectorum), often form an understory. Fire control, acting in concert with livestock grazing, permitted the invasion of the valley floor by western juniper (Juniperus occidentalis), which had formerly been restricted to hillsides and rock outcrops surrounding the valley.

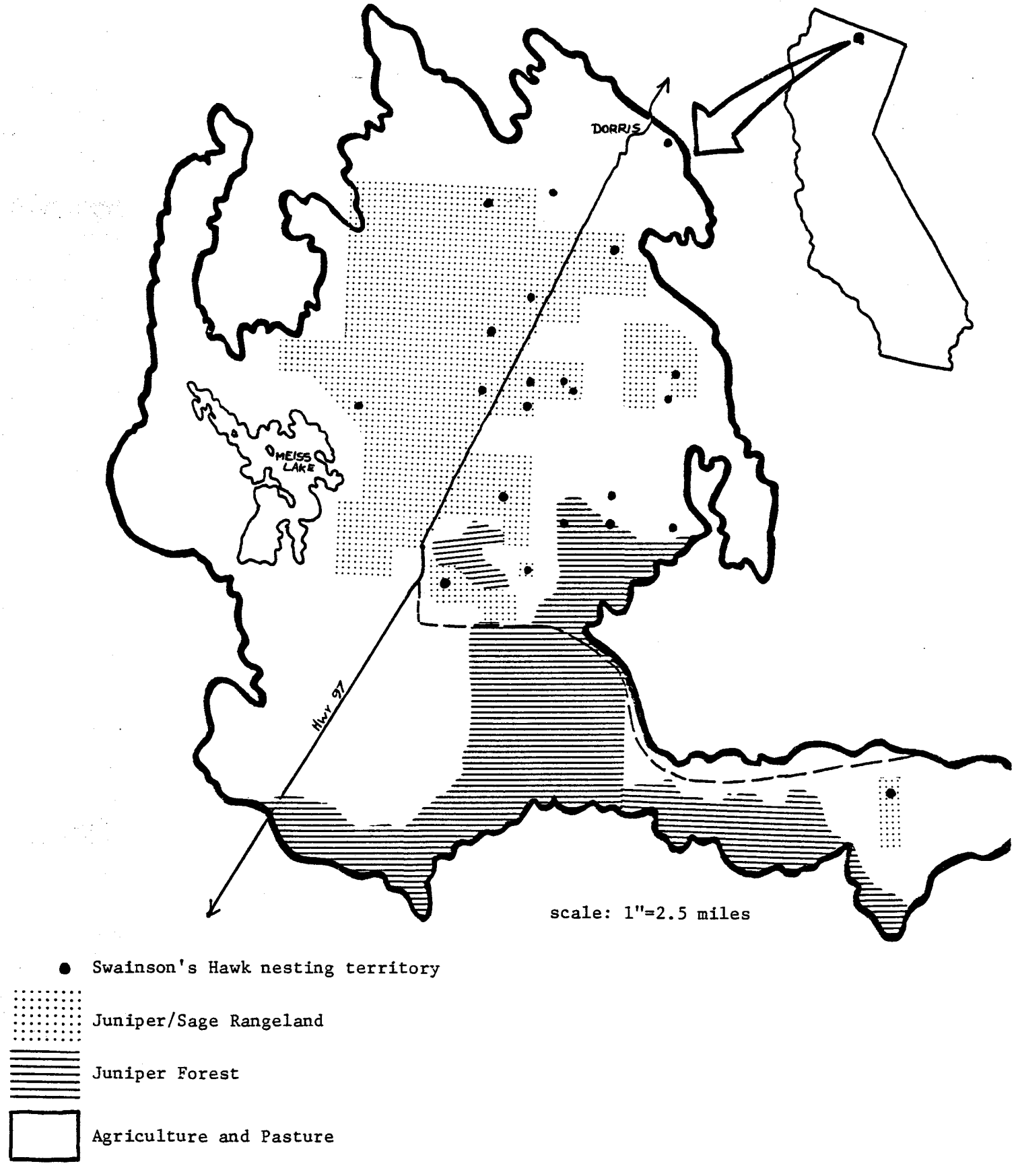
Presently, agriculture comprises the majority of the valley floor. Only about 23,000 acres of native type vegetation remain in 1985, with conversion to agriculture occurring annually. Most of this native vegetation exists on the 18,000 acre Federal Land Utilization Project (LUP), the largest single holding in the valley. Approximately 6,000 acres of grassland/wetland, with no trees, exist on the California Department of Fish and Game-administered Butte Valley Wildlife Area. About 680 acres of native vegetation are administered by the Bureau of Land Management. The remainder of the valley is composed of three large ranches and about 150 small parcels ranging from 40 to 1,000 acres. The current trend in land ownership is toward fewer owners and larger ranches. Irrigated alfalfa, potatoes, and grain are the dominant crops grown in the Buttte Valley.

## METHODS

Between 10 April and 30 September, 1985, roadside transects were driven at two to five day intervals through suitable habitat in the Butte Valley. Transect routes included known Swainson's Hawk territories, as well as large areas of previously unsurveyed habitat and agricultural areas. Intensive ground searches were conducted in areas where adult Swainson's Hawks were observed. Roadless areas and high capability habitat were searched on foot or using an off-road motorcycle. The widely scattered distribution of Juniper trees in the study area permitted investigation of virtually all trees over large areas.

To avoid disturbance of nestbuilding or incubating Swainson's Hawks, early survey work was restricted to roadside transects. The presence of a single adult Swainson's Hawk was used to indicate a nesting territory (Bloom 1979). As the nesting season progressed, however, we found that some pairs were extremely secretive, nesting undetected within 50 meters of transect routes. Repeated transects and ground searches resulted in discoveries of new nests as late as August 11. Interpretation of survey data in 1985 was complicated by high frequency of egg loss by nesting Swainson's Hawks, resulting in

Fig. 1. Map of Butte Valley, Siskiyou Co., California showing habitat types and Swainson's Hawk nesting territories studied in 1985.



wandering, nonterritorial adults.

Nests were visited in late June to determine reproductive success and chronology. Eggshell fragments, addled eggs and prey remains were also collected. Return visits to each nest were timed to coincide with chick ages of two to four weeks. At this time the nestlings were banded with standard aluminum USFWS bands, and additional prey remains collected. Fledging success was determined by checking territories shortly after estimated fledging dates. A final collection of prey remains was made in early September.

Adult Swainson's Hawks were trapped on their nesting territories during July. Capture of adult birds was accomplished using a mist net with a live Great Horned Owl as a decoy. Standard USFWS bands and individually numbered colored legbands of laminated plastic were placed on each breeding adult. Standard measurements and photographs were taken of each bird trapped.

Observations were aided by the use of 10x50 binoculars and a 15-60x zoom spotting scope. Prey remains collected at nest sites were identified by comparison with specimens in the Vertebrate Museum at Humboldt State University, Arcata, California. Addled or broken eggs were sent to the Western Foundation of Vertebrate Zoology to be analyzed for environmental contaminants.

## RESULTS AND DICUSSION

### Abundance of Swainson's Hawks in the Butte Valley

Currently, 24 Swainson's Hawk nesting territories have been identified in the Butte Valley (table 1). Twenty of these territories were active in 1985. Based on analysis of: 1) the quantity and distribution of suitable habitat in the valley, 2) the proportion of surveyed to unsurveyed areas and 3) sightings of adult birds, a total population of 35 pairs was estimated.

### Banding Results

Eleven nesting pairs of Swainson's Hawks were color-banded in 1984 and 1985 in the Butte Valley. At three additional nests only one adult could be trapped and colorbanded. All adults colorbanded in 1984 returned to their territories in 1985.

Thirty-eight nestling Swainson's Hawks were banded (16 in 1984, 22 in 1985) in the Butte Valley. One notable band return was recorded in 1985. At Busw 508 a banded adult breeder was trapped- it had been banded as a nestling at an adjacent territory in 1979 by Peter H. Bloom.

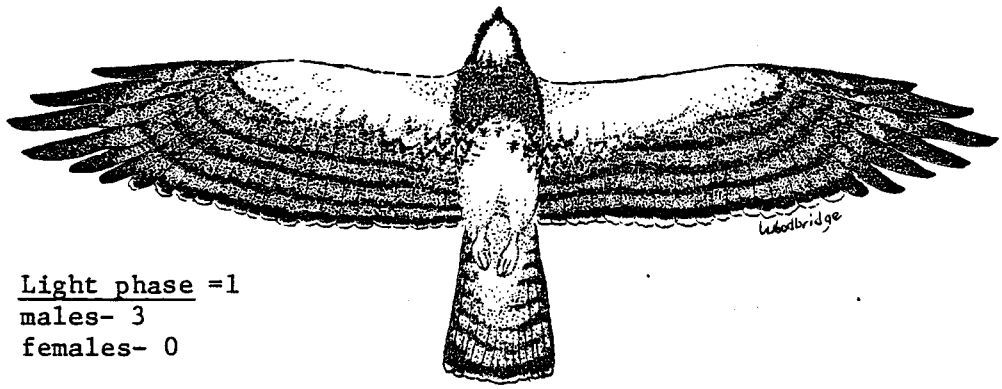
Plumage Color

Wide variation in plumage coloration between individual Swainson's Hawks were recorded in the Butte Valley. Body plumage ranged from very light contrasty plumage to entirely melanistic. Color of the wing linings seemed to vary independently of body color. Four distinct plumages were recognisable (Fig. 3). Darker plumages (numbers 3 and 4) predominated, with only 26 percent of adults displaying light (numbers 1 and 2 ) plumages. A highly significant* degree of sexual dichromatism existed in the 15 pairs of Butte Valley Swainson's Hawks that were examined. Males tended to be lighter: 89 percent of light plumaged birds were males. By contrast, only 33 percent of dark plumaged birds were males. Breeding pairs frequently exhibited sexual dichromatism; in these cases the male was always lighter than the female. The only light phase female recorded in the study was paired to an even lighter male.

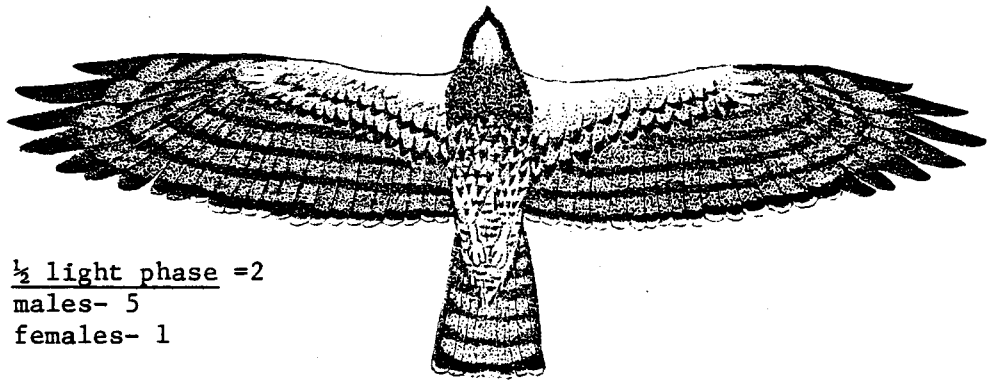
The ecological significance of this sexual color difference is not known. An increase in the Butte Valley sample size and comparison with other populations will be necessary before any conclusions may be drawn, however the relative degree of sexual dichromatism between different populations may indicate the degree of isolation between populations.

*(t=3.90, P=.005, df=14)

Figure. 2. Variations in plumage coloration of Swainson's Hawks observed in the Butte Valley, Siskiyou Co., California. Numbers of each sex in each plumage category are included. Numerical coefficients (= 1 to 4) were used in analysis of sexual dichromatism.

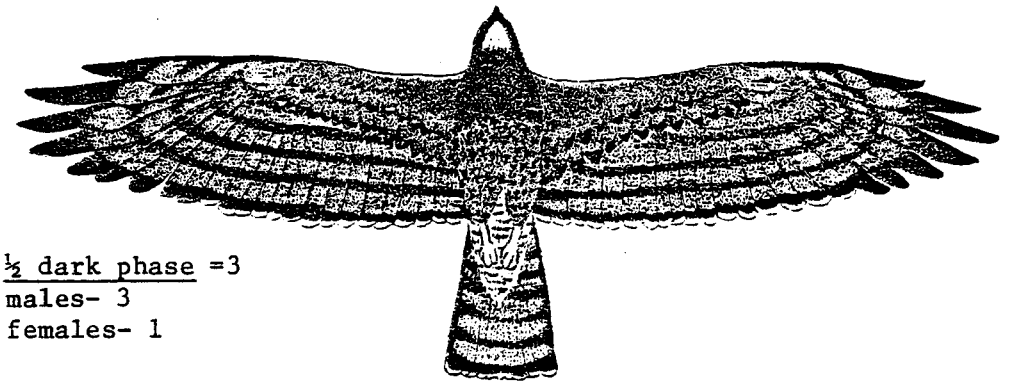



Light phase =1
males- 3
females- 0

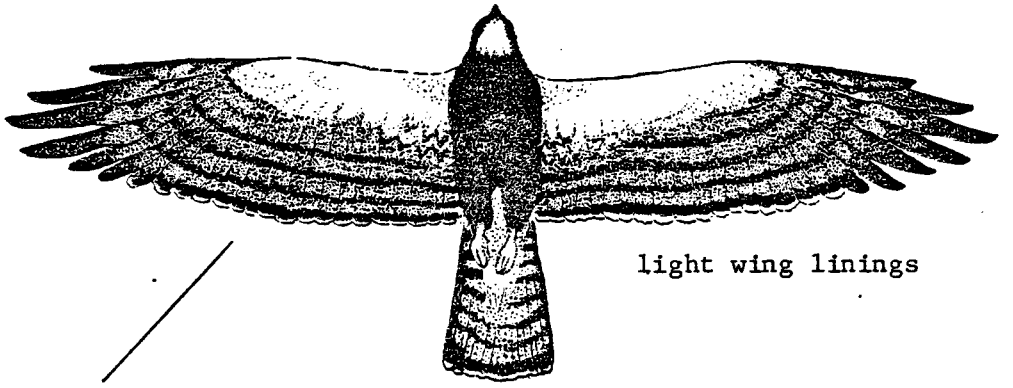


½ light phase =2
males- 5
females- 1

Fig. 2. Plumage variations (cont.)

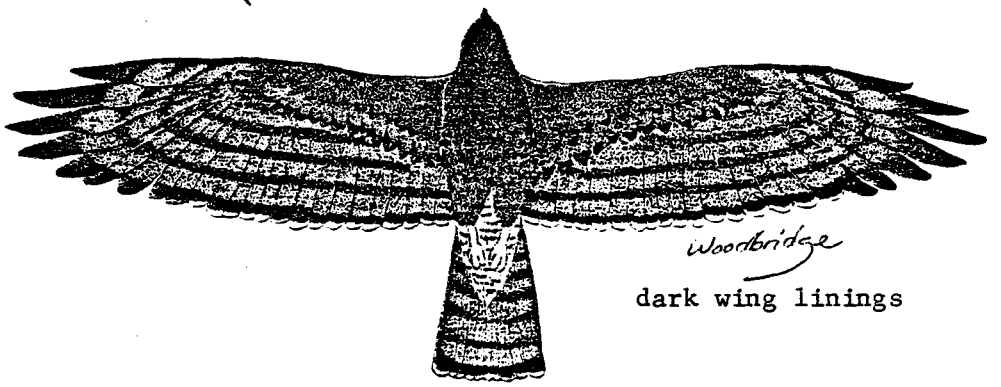


½ dark phase =3
males- 3
females- 1



light wing linings

Full dark phase =4
males- 4
females- 13



Woodbridge

dark wing linings

Arrival on Breeding Grounds

Swainson's Hawks were not seen on roadside transects until April 24,1985. During the last week in April, groups of three to five adult Swainson's Hawks were observed perched in close proximity to each other on fencerows or powerpoles near existing territories. Observation of colorbanded individuals indicate that pairs migrate together- both members of a pair arriving at the territory simultaneously. For example, a group of five adults seen perched together on April 28 consisted of two colorbanded pairs (Yellow 14 and Black 09) and a single unbanded bird. These birds spent over a week on what was later to be the Yellow 14 territory (Busw 511) before separating. The arrival of Swainson's Hawks in the Butte Valley roughly coincides with the emergence of large numbers of immature Beldings Ground Squirrels (Citellus beldingi) from their burrows. Foraging groups separated into pairs after one to three weeks, after this time pairs remained in the vicinity of their nest trees. Female Swainson's Hawks were rarely seen at this time, males often perched on the nest tree or a nearby powerpole.

Egglaying and Incubation

In the Butte Valley, incubation usually began between May 10 and May 20 (range in 1985: May 9 to June 9). In 1985, Swainson's Hawks exhibited less synchronicity of egglaying dates than in 1983 or 1984, with differences of up to 25 days occuring between adjacent pairs. Causes for such differences in egglaying dates may include asynchronous arrival of pairs on the breeding grounds, disturbance or habitat loss during courtship or nestbuilding, or recycling after loss of eggs early in incubation. Although laying of replacement clutches has rarely been documented for western Swainson's Hawks (see Sharp 1902), there is some evidence that it may have occurred at two Butte Valley sites in 1985.

At one of the sites (Busw 514) the adult hawks were observed incubating on May 6. On July 3 this nest was found to be abandoned and contained broken eggshells. In a tree approximately 70 meters from this abandoned nest, a pair of Swainson's Hawks was brooding five day old nestlings.This indicates a laying date near May 28, about two later than average. The adult hawks continued to defend both the abandoned and active nest trees until late August.

At site Busw 515, hatching did not occur until July 9, indicating an egglaying date of June 9, about 26 days later than the average. A search of the territory on August 20 revealed a recently used but abandoned Swainson's Hawk nest about 60 meters from the active nest. As at Busw 514, the adult hawks vigorously defended both the active and abandoned nest trees. Caution should be exercised in interpreting this evidence, and further early-season investigation of marked Swainson's Hawk pairs will be necessary before the question of recycling in this species is resolved.

At sites which failed, nest defense by the adult hawks frequently continued for weeks after the loss of eggs or young.

During incubation Swainson's Hawks tended to be inconspicuous, flushing from nests only when a human intruder approached to within 20

meters or contacted the nest tree. Observations of sexually dichromic or colorbanded pairs indicates that incubation is performed almost entirely by the female. Males often perched on the nest tree, adjacent trees or powerpoles during the day, but were frequently absent from the territory for up to four hours. This, combined with the relatively concealed placement of Swainson's Hawk nests, resulted in low detectability for nests of this species during May and early June.

Brooding and Nestling Phase

Incubation usually ceased in mid-June, with 70 percent of eggs hatching between June 15 and June 21. The latest hatching date recorded in 1985 was July 9. Two pairs of Swainson's Hawks were observed incubating addled eggs as late as July 7. Approximately one week after hatching the activity level at each nest site increased dramatically. Females perched on or directly above the nest for much of the day, shading and guarding the nestlings. High temperatures (85 to 95 degrees F) during this period probably reduced the need for day brooding. Adult males were also more visible, making frequent flights to the nest tree to deliver prey or to perch. Defensive behavior by both adults increased after hatching; flushing distances and intensity of vocalizations were noticeably higher than during incubation. Unlike other Buteos, Swainson's Hawks frequently displayed aggressive nest defense; diving to within three to ten feet of researchers in or near nest trees.

Nestlings began to perch on the nest rim at about four weeks of age. Fledging dates between nestmates often varied by five days or more. At two nests (Busw 515 and 511) the oldest fledgling was flying and joining the adults in nest defense while it's younger sibling had not yet fledged. Actual fledging dates were not estimated because; 1) fledged young often perched on the nest during the day and 2) close investigation would have caused premature fledging. Assuming a fledging age of 43 days, a mean fledging date of August 18 was estimated. The latest fledging date observed was about August 23 to 26.

Fall Migration

Swainson's Hawks began exhibiting migratory behavior in early September. On September 3 a group of five adults was observed soaring over an occupied territory. Observations of groups of three to seven hawks increased until September 10. After this date 85 percent of active territories were vacant and soaring groups were not seen. Adult Swainson's Hawks, but no juveniles, were present on three territories (Busw 524, 515 and 504) as late as September 15. On September 15 a group of five birds was seen soaring over the Busw 504 territory. One pair in this group performed repeated 'tumbling' displays; one hawk diving from above and locking talons with the other, both falling a short distance before separating. Swainson's Hawks could not be located in the Butte Valley after September 15.

Nesting Habitat

In the Butte Valley, Swainson's Hawks nested in sparsely distributed trees on the level valley floor. All nests were in Western Junipers ranging from four to nine meters in height. Nests tended to be in single isolated trees, small clumps of three to six trees, or rarely,at the edges of dense juniper stands. Tree densities on territories in undisturbed rangeland habitats ranged from .025 to .27 trees per acre.

Nesting habitat was characterized by two broad categories: Rangeland sites ( > .5 miles from agricultural fields) and Agricultural sites ( < .5 miles from fields).

Although the majority of juniper trees in the Butte Valley are located in large expanses of sage rangeland, only three active Swainson's Hawks nests (16 percent) were detected in this habitat in 1985. All of these nests failed.

Over 83 percent of Swainson's Hawk nests found in this study were located less than .5 miles from cultivated fields. Eleven nests were found in isolated patches of juniper/sage (10 to 640 acres) within agricultural areas or in edge zones between rangeland expanses and cultivated fields, particularly alfalfa. An additional four nests were located in scattered junipers along fencerows, in field corners or near farm buildings.

Densities of nesting Swainson's Hawks were highest in isolated patches of junipers surrounded by extensive alfalfa fields. Nests in these islands ranged from .25 to .70 miles apart, and probably represent minimum territory sizes for this species. The heavy utilization of the few trees within agricultural areas in the Butte Valley suggests that the availability of suitable trees may be a limiting factor for Swainson's Hawks nesting in these areas.

Swainson's Hawk nests examined in the Butte Valley ranged in size from 43 to 62 cm. in width and 11 to 31 cm. deep. Nests of this species were considerably smaller and constructed of smaller sticks than nests of Red tailed Hawks. Swainson's Hawk nests were usually placed in a relatively concealed position within the tree and were 44 to 83 percent screened by foliage. By comparison, Red tailed Hawk nests were more exposed.

Food Habits and Foraging Behavior

Analysis of prey remains collected at nests in the Butte Valley indicate that Swainson's Hawks prey on a wide variety of vertebrate and some invertebrate prey (table 2). Mammalian prey constituted over 60 percent of prey items identified. Microtines contributed 43 percent of observed prey items. Belding's Ground Squirrels accounted for only 12.5 percent of observed prey items, however due to it's large size this rodent probably comprises a major proportion of prey biomass. Avian prey accounted for 25 percent of prey items identified, with some nests (Busw 514 and 520) exhibiting high proportions of bird remains (36 and 60 percent, respectively). Reptiles and insects composed 15 percent of observed prey. A total of 14 prey species were identified in 1985.

The primary prey species of Butte Valley Swainson's Hawks are positively associated with cultivated areas, particularly alfalfa (pers. obs., and Anderson pers. comm.). Despite regular rodent control programs, spectacular densities of Beldings Ground Squirrels (up to 2 squirrels per square meter) were recorded in several alfalfa fields. Colonies of Belding's Ground Squirrels were observed in some range areas, particularly where range improvement programs had converted sage to lower-structured vegetation such as Crested Wheatgrass. The Sage Vole (Lagurus curtatus) was the only significant prey species identified which is usually associated with sagebrush.

Foraging strategies exhibited by Swainson's Hawks were closely tied to agricultural practices. During planting and harvesting activities, ground squirrel and vole populations were displaced from their burrows and became highly vulnerable to avian predation. Asynchronous planting and cutting schedules in alfalfa growing areas provided a constantly shifting mosaic of disturbed foraging areas for Swainson's Hawks. Over 95 percent of observations of actively foraging birds were in alfalfa fields which had recently been cut, or where harvesting was underway. During alfalfa mowing or baling operations, adult hawks representing several nesting pairs would congregate in the vicinity, perching on fenceposts or hay bales and capturing rodents exposed by moving farm machinery. Observations of colorbanded birds show that Swainson's Hawks may travel two to five miles to forage in freshly mowed alfalfa fields. Foraging activity was not observed in potato or strawberry fields.

Seasonal changes in the behavior of Belding's Ground Squirrels have a dramatic effect on Swainson's Hawk diets in the Butte Valley. In late April when most Swainson's Hawks were arriving in the valley, large numbers of immature squirrels were emerging from their burrows. These squirrels remained active and vulnerable until late June, when warm temperatures forced them to remain underground for increasing periods of time. In July the squirrels began to estivate and were very rarely seen aboveground. Belding's Ground Squirrels were the dominant prey species identified from prey remains collected before July 10, but were virtually absent in subsequent nest checks, being replaced by Montane Voles and an increasing proportion of other rodents and birds. Thus, during the period of peak dietary demand by nestling Swainson's Hawks, (August 5 to August 10), a major prey species was largely unavailable.

Table 2. Prey species identified from prey remains collected at Swainson's Hawk nests in the Butte Valley, California in 1985.

| Prey species | number | percent of total |
|---|---|---|
| Mammalian | 67 | 60.9 |
| Belding's Ground Squirrel (Citellus beldingi) | 14 | 12.7 |
| Least Chipmunk (Eutamias minimus) | 1 | .9 |
| Dusky footed Woodrat (Neotoma fuscipes) | 1 | .9 |
| Montane Vole (Microtus montanus) | 43 | 39.1 |
| Sage Vole (Lagurus curtatus) | 4 | 3.6 |
| Western Red backed Vole (Clethrionomys occidentalis) | 1 | .9 |
| Deer Mouse (Peromyscus sp.) | 1 | .9 |
| Heerman's Kangaroo Rat (Dipodomys heermanni) | 1 | .9 |
| Mountain Cottontail (Sylvilagus nuttalli) | 1 | .9 |
| Avian | 27 | 24.5 |
| Brewer's Blackbird (Euphagus cyanocephalus) | 5 | 4.5 |
| Lark Sparrow (Chondestes grammacus) | 1 | .9 |
| unid. passerine | 21 | 19.1 |
| Killdeer (Charadrius vociferus) | 1 | .9 |
| Reptilian | 1 | .9 |
| unid. snake | 1 | .9 |
| Insect | 15 | 13.6 |
| Tenebrionid Beetle | 13 | 11.8 |
| Locust | 2 | 1.8 |
| 14 species identified | 110 items | |

Reproductive Performance

Of the 24 known Swainson's Hawk territories in the Butte Valley, 20 (83 percent) were occupied in 1985. Eighteen active nests were examined in 1985. At two additional sites, defensive adults were present but the nests were not located. Sixty-six percent of the 18 active territories were successful in fledging young in 1985 (table 1). Twenty-four nestlings (ages one to four weeks) were counted during banding (1.3 nestlings per active nest). Two nestlings did not survive to fledging. Fledging success in 1985 was 1.2 fledglings per active nest (1.83 per successful nest), compared to 1.0 fledglings per active nest in 1984.

Nesting failure due to loss of eggs during incubation occurred in six (33 percent) of the active Butte Valley nests in 1985. In 1984, 36 percent of eleven known nests failed during incubation. Egg loss was indicated if: 1) failure and subsequent abandonment occurred prior to the earliest known hatching date in the valley or 2) addled or broken eggshells with yolkstains were retrieved from abandoned nests. In addition, addled eggs and remains of unhatched eggs were collected from three nests also containing young.

Several factors may be responsible for the low hatching success observed in the Butte Valley in 1985. Low prey availability, unfavorable weather conditions, disturbance of incubating adults and effects of environmental contaminants may act singly or in concert to reduce hatching success. Data do not currently exist to support a major role of pesticides or other environmental contaminants in causing reproductive failure in 1985, however the relatively high incidence of birds in the diets of Butte Valley Swainson's Hawks suggests that pesticide accumulation may be occurring. As most unsuccessful nests were located in fenced, relatively isolated range areas, disturbance is unlikely to have caused widespread failure.

Marked differences in size and condition between oldest and younger nestlings became apparent from ten to fifteen days after hatching. Chronically undernourished nestlings developed a characteristic blue-gray down, markedly different from the white down of their larger nestmates. At all three-chick nests (Busw 508,514,511) the youngest nestling suffered from malnutrition and did not survive to fledging. In addition, many one and two chick nests which were not examined until mid-July may have already undergone brood reduction. At Busw 508 the the youngest nestling was removed after repeated attacks by its older siblings left weak and bloody. This chick was fostered into a single-chick nest where it fledged successfully. Brood reduction and fratricide in Swainson's Hawks has been linked to low prey availability (Bechard 1983), and together with the presence of blue-gray nestlings at one- and two- chick nests, may indicate poor foraging success for nesting Swainson's Hawks in the Butte Valley in 1985.

Table 1 Reproductive Data for Butte and Shasta Valley Swainson's Hawks in 1985.

| USFS # | Territory Name | Location | #eggs | # young | # fledged |
|---|---|---|---|---|---|
| BuSw 501 | Richardson Road | T47N,R1W,Sec.4,NE¼ | unk. | 2 | 2 |
| BuSw 502 | Upper Meiss Road | T47N,R1W,Sec.21,NE¼ | inactive | | |
| BuSw 503 | Meiss Lake Corner | T47N,R2W,Sec.25,SE¼ | 2 | failed | |
| BuSw 504 | Sheep Mountain X | T46N,R1W,Sec.11,S½ | 3 | 1 | 1 |
| BuSw 505 | Airport | T47N,R1W,Sec.28,SE¼ | unk. | failed | |
| BuSw 506 | Bushy Juniper | T47N,R1W,Sec.17,NW¼ | inactive | | |
| BuSw 507 | Racetrack | T46N,R1W,Sec.3,SW¼ | unk. | 2 | 2 |
| BuSw 508 | Alston I | T47N,R1W,Sec.27,SE¼ | unk. | 3 | 2 (- foster) |
| BuSw 509 | Alston IV | T47N,R1W,Sec.27,NE¼ | inactive | | |
| BuSw 510 | Plowed Field | T47N,R1W,Sec.2,NE¼ | inactive | | |
| BuSw 511 | Alfalfa | T46N,R1W,Sec.1,SE¼ | unk. | 3 | 2 |
| BuSw 512 | Juniper Knoll | T46N,R1W,Sec.15,NE¼ | unk. | 2 | 2 |
| BuSw 513 | BLM Pine | T47N,R1W,Sec.15,SE¼ | unk. | failed | |
| BuSw 514 | Alston II | T47N,R1W,Sec.26,NE¼ | unk. | 3 | 2 |
| BuSw 515 | Chet & Suzi's | T48N,R1E,Sec.31,NE¼ | 2 | 2 | 2 |
| BuSw 516 | Cedar Point | T47N,R1W,Sec.12,SE¼ | 2 | failed | |
| BuSw 517 | Lassiter | T46N,R1E,Sec.7,NE¼ | 2 | 1 | 2 (+ foster) |
| BuSw 518 | Buick | T47N,R1E,Sec.30,SE¼ | unk. | 2 | 2 |
| BuSw 519 | North of Buick | T47N,R1E,Sec.29,NW¼ | unk. | failed | |
| BuSw 520 | Army Lake | T45N,R1E,Sec.7,NW¼ | unk. | 2 | 2 |
| BuSw 521 | Alston III | T47N,R1W,Sec.26,N½ | min. 2 | failed | |
| BuSw 522 | Fitzgerald Ranch | T45N,R1E,Sec.7 or 8 | defending pair found, nest not located | | |
| BuSw 523 | Macdoel | T46N,R1W,Sec.17,SW¼ | unk. | 1 | 1 |
| BuSw 524 | Caldwell Ranch | T46N,R1W,Sec.12,? | defending pair found,nest not located | | |
| BuSw 525 | Gazelle | T43N,R6W,Sec.16,NE¼ | unk. | 2 | 2 (Shasta Valley) |

Threats to Population

Although problems such as environmental contaminants, shooting and loss of wintering birds cannot be ruled out at causes for the decline of the Swainson's Hawk in California, evidence from this study suggest that loss of nesting and foraging habitat is a primary limiting factor for this species in the Butte Valley. It has been argued that these factors should also affect sympatric Red tailed Hawk populations, which show no sign of decline, however Red tailed Hawks take larger prey such as Blacktailed Jackrabbits (Lepus californicus) and California Ground Squirrels (Citellus beechyi) and have much broader habitat requirements than Swainson's Hawks. Red tailed Hawks also nest over a month earlier than Swainson's Hawks enabling them to exploit Belding's Ground Squirrels during the entire nesting cycle.

Analysis of territory locations and habitat types suggests that differential prey availability in several habitats may affect the success of pairs nesting in those habitats. Pairs nesting in sagebrush areas had significantly lower reproductive success than pairs associated with agriculture. One hundred percent of nests located more than one mile from alfalfa fields failed, compared with 14 percent of nests less than .5 miles from fields. Reduced availability of rodent prey in dense sagebrush areas has been described (Bechard 1980, 1983). By contrast, rodent populations in agricultural fields, particularly alfalfa and grain, are artificially maintained by seeding and watering, and regularly made vulnerable by harvesting activities.

Reduction of Swainson's Hawk habitat in the Butte Valley is the result of two separate land-use activities. Overgrazing in rangeland areas creates dense sagebrush stands where availability of rodent prey is low, forcing birds nesting in these areas to fly considerable distances to forage over agricultural fields. Prime nesting habitat is limited to agricultural areas where few suitable nesting trees exist. Tree removal in these areas continues at a steady pace to facilitate expansion of irrigation systems and consolidation of fields. During the 1985 survey, two active nests were found in trees scheduled for removal during the nesting season. Several patches of juniper/sage habitat in the valley are scheduled for conversion to cropland within the next five to ten years. Interviews with local landowners indicate that at least five Swainson's Hawk territories will be lost or displaced by 1995.

The type of crops grown in Swainson's Hawk nesting areas also affects nesting success. Increases in the proportion of potatoes or strawberries grown in the valley will directly reduce the foraging habitat available to breeding hawks.

## MANAGEMENT FOR SWAINSON'S HAWKS IN THE BUTTE VALLEY

Habitat Management

Two basic strategies of habitat management for Swainson's Hawks in the Butte Valley have been examined: improvement of rangeland habitats on federal lands and protection or planting of nest trees in privately-owned agricultural areas. Interviews with Butte Valley landowners, Soil Soil Conservation Service personnel and U.S. Forest Service personnel resulted in the following management recommendations.

Rangeland Improvements: Presently, the edge zone between USFS and BLM administered rangelands and privately owned agricultural areas supports over 40 percent of known Butte Valley Swainson's Hawk nests, and includes many of the available nest trees. Maintenance of the trees in these areas will be of increasing importance to Swainson's Hawk management as privately owned trees are cleared.

The greatest opportunity for improvement of Swainson's Hawk habitat on federal lands is range improvement on the USFS- administered Butte Valley L.U.P. Conversion of dense sagebrush stands to low structured vegetation by chaining, disking and grass seedings is a standard range improvement technique and would benefit Swainson's Hawks by increasing prey availability. Johnstone et. al. 1980 describes a positive association between nesting Swainson's Hawks and Crested Wheatgrass seedings in southeastern Oregon. Populations of Belding's Ground Squirrels should increase in treated areas. Range treatments should also enhance Pronghorn Antelope habitat and livestock grazing. Present grass seedings on the L.U.P. (approx. 1500 acres) are overgrazed and located in treeless areas: planting of suitable tree species in these areas may be feasible.

Management on Private Lands: Conservation of existing junipers and establishment of trees in areas where they have been eliminated are the primary tools of Swainson's Hawk management on private lands in the valley. In 1985 an education program aimed at involving Butte Valley ranchers in Swainson's Hawk management resulted in the direct preservation of four active territories. It is hoped that continuation of this education program by private groups* and agency biologists will further increase awareness of the requirements and beneficial effects of Swainson's Hawks in agricultural areas.

Various federal conservation programs exist which may prove effective for protecting or enhancing Swainson's Hawk habitat on private lands. The most promising of these is an Agricultural Stabilization and Conservation Service (ASCS) administered cost-sharing program to provide windbreaks in agricultural areas. This program could be utilized to create strips of suitable nest trees (Black Locust, Cottonwood, Juniper) in areas where trees have been eliminated. Under this program, the ASCS pays up to 75 percent of the costs of establishing tree windbreaks on private farmlands.

A potential tool for conserving Swainson's Hawk nesting habitat lies in the 1986 Farm Bill. A Farm Bill amendment provides a 'sodbuster' provision which limits or removes subsidies for farmers who plow up

marginal or erosion-prone lands. Much of the privately owned juniper/ sage in the Butte Valley is marginal or unsuitable for cultivation and would be considered for this program.

* Ca. Dept. of Education; Environmental/Energy Education Grant Program Wildlife Survey and Enhancement Project, Jackson Street School Science Club.

Manipulative Management

The poor reproductive success of Butte Valley Swainson's Hawks in 1985 provided some opportunities for investigation of the bird's responses to manipulation of eggs and young. Manipulation was attempted only at nests which were already failing or contained a nestling that in our opinion would not survive to fledging.

At two nests (Busw 503 and 516) the adults continued to incubate for 20 days after the average valley fledging date. When these nests were checked on July 7 the adult birds abandoned the addled eggs and did not return, although they had been incubating previous to the disturbance. Because we were unable to determine whether a nest had failed until it was abandoned, we could not attempt to foster young into nests with inviable eggs. In the absence of eggshell thinning data or some other clue to indicate which Swainson's Hawk pairs will fail in a given year, manipulation will necessarily be limited to distribution of nestlings from crowded nests to nests with fewer young. Examination of eggs by candling in mid-to late June(just after the mean hatching date) may prove effective in determining whether a site is failing before the eggs are abandoned, however the propensity of Swainson's Hawks to temporarily or permanently abandon disturbed nests makes this a risky management technique.

Fostering of smaller siblings from three-and four chick nests into nests containing only a single nestling may increase total productivity by circumventing brood reduction in the larger brood. The extremely low survival rate of gray-downed youngest nestlings (Bloom pers. comm.) makes fostering of these nestlings virtually risk-free. To avoid placing foster chicks into nests where brood reduction has already occurred, fostering should should be attempted within two weeks of hatching (brood reduction usually occurs after 14 days; Bechard 1983), or at nests where addled eggs indicate that only one chick hatched.

A single attempt at fostering was made in 1985. On July 12 the smallest of three nestlings was removed from Busw 508. The nestling was weak and had superficial wounds on it's head. The 15 day old nestling was fed mice for 48 hours and then placed into Busw 517, which on July 3 had contained a single nestling and an addled egg. The adult hawks accepted the new nestling immediately and it fledged successfully in mid-August.

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